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JPRS Report

Telecommunications

EEC 5-YEAR PLAN FOR INTEGRATION
OF INFORMATICS SERVICES

JPRS-TTP-87-017

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TELECOMMUNICATIONS

EEC 5-YEAR PLAN FOR INTEGRATION OF INFORMATICS SERVICES

Luxembourg GUIDELINES FOR AN INFORMATICS ARCHITECTURE 1986-1991 in English Nov 86 pp 2-35, Annex pp 1-7

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/6091

[Text] 0. SUMMARY

The Commission of the European Communities has produced a set of guidelines for the way informatic services should be used within its own administration, and for the way informatics resources should be deployed. It is expected that they will lay the foundations of a well-coordinated plan for procurement and implementation of informatics across European Institutions.

The plan, as expressed by these guidelines, has, as its basic aim, to allow the European Institutions to :

- **Be free to choose the best way of adopting and integrating new technology independently of the policy of individual manufacturers.**

The stated objectives to achieve this aim are :

* To modernise the administration of the European Institutions and organise the flow of information between them and the Member States Administrations by the INSIS programme (Interinstitutional System for Integrated Services).

* To implement a multi-vendor procurement policy, showing that it is economically justified in a standardised environment.

* To promote cooperation between manufacturers in promulgating standards and adhering to them.

* To strengthen interinstitutional cooperation in informatics allowing the sharing of benefits resulting from the combination of the purchasing power of separate Institutions.

* To set an example to public and private bodies in Europe in procurement policy for informatics products.

There are two main, closely related, fronts through which the guidelines propose to implement these aims :

- A coherent policy in implementing standards ;

- A rational deployment of informatics resources, reflecting more closely the way user communities are organised.

Standards are essential for intercommunication between institutions and eventually interworking. They are also essential for interconnection, intercommunication and interworking within a single institution. Last, but not least, they are essentiel for the independence from individual manufacturers, the protection of investment against obsolescence and for the free competition within the informatics industry.

The guidelines adopt fully, and on a mandatory basis, the implementation of the principle of Open Systems Interconnection (OSI) for all matters that involve communication between different equipment and institutions. They go further than the OSI principle, however, by proposing practical ways of cooperating in the implementation of application systems with view to interworking on an user-to-user basis, as opposed to simply machine-to-machine.

The proposed measures include the urgent adoption of a standards intercept strategy, in concert with the manufacturers who will implement them on their products, as well as the adoption of a limited range of software products to avoid the proliferation of incompatible systems. A good example of the latter is a decision not to introduce new proprietory operating systems, and the choice of transportable ones, such as UNIX and MS-DOS. These enhance the common development and interchange of applications, and make possible the introduction of an unified user environment.

The deployment of informatics resources proposed in the guidelines is based on a distributed architecture which reflects closely the way user communities are organised. The open systems principles resulting from the adoption of suitable standards provide the flexibility needed to implement the proposed architecture.

Essentially, this is a two level architecture which distinguishes, within an Institution, between Local Support Units (LSUs) dedicated to a local user community with a close working relationship and Common Support Units (CSU) dedicated to the organization as a whole.

LSUs are intended to cover flexibly the different user requirements of different user communities. CSUs are used for services that cannot be provided economically within a small user community, cannot be practically distributed (e.g. common data bases), or are centralised by definition, such as common accounting, communication between organizations, etc.

The guidelines recognise the fact that the capabilities offered by information technology finally reach the users in the form of different services such as electronic mail, personal computing, access to data bases, etc. For this reason, a substantial part of the guidelines is dedicated to these services and is of a dynamic nature. The guidelines for the implementation of services will be constantly under review and new guidance will be added as experience is gained and as new requirements materialise.

The guidelines also recognise the fact that the transition from a manufacturer oriented architecture to an open one allowing full interworking cannot be achieved overnight. The guidelines foresee an evolutionary plan which will gradually attain the intended goal. This plan contains valuable information for the industry on the difficulties a customer meets when implementing a multi-vendor standards policy.

It is believed that the plan inherent in the guidelines is both urgent and timely. Although information technology is not new and expands at an increasing pace, its usage in a wide scale is still in its formative stages. A plan, and the cooperation of all manufacturers of the expanding technology in it, is essential if the resulting systems are to allow users in different organisations to interwork.

1. INTRODUCTION

The unprecedented growth in information and communication technology of the past years presents both challenge and opportunity to user organisations.

The opportunity is that technology can be applied to enhance the effectiveness and efficiency of organisations to a higher degree than was possible before.

The challenge is caused by the proliferation of products which makes standardisation a pre-requisite for integration.

It is in the interest of all, and especially of large organisations, to :

> **Remain free to choose the best way to adopt and integrate new technology independently of the policy of individual manufacturers.**

In addition, the European Institutions must cope with the complexity caused by different languages and partners in remote geographical locations. This turns the interest into a necessity, and dictates conditions for a high degree of flexibility in implementing these technologies.

The degree of interaction between the European Institutions makes essential the adoption of a master plan for implementing the growing technologies. This should encompass communications and areas of common interest between European Institutions and the Administrations of the Member States of the European Community.

The proposed master plan (the **Informatics Architecture of the European Institutions**) has as its main elements :

* **A distributed data processing architecture.**
* **A multi-vendor procurement policy.**
* **Common standards for system interworking.**
* **Maximum transportability of software.**

This architecture ought to reflect more than the solution to the needs of the European Institutions. The European Institutions have to play a leading role to encourage harmonisation in informatics, which should be to the benefit of European industry at large.

The following objectives are, therefore, adopted to achieve the goals set out earlier :

a To modernise the administration of the European Institutions and organise the information flow between them and the Member State Administrations by the INSIS programme (Interinstitutional System for Integrated Services), and CADDIA (Cooperation in Automation of Date and Documentation for Import/Export and Agriculture).

b To demonstrate that a multi-vendor procurement policy is economically justified in a standardised environment because it reduces the cost of dependence on a single supplier while avoiding the cost of hardware redundancy.

c To obtain an undertaking from manufacturers to cooperate in promulgating standards and to comply with them in the products they offer to all their customers.

d To strengthen interinstitutional cooperation in informatics. This will allow the sharing of benefits between Community Institutions who have their own purchasing power.

e To set an example to public and private bodies in Europe in procurement policy for informatics' products.

The tasks set out are not easy. Most architectures have been designed by the computer manufacturers to fit with their present and future product ranges. Such architectures are, generally, mutually incompatible even if OSI standards are applied. A multi-vendor architecture can only be developed by the customer, but no single customer has the power to impose a given architectural design on industry. A multi-vendor architecture must, consequently, result from the iterative process of demand and supply.

This is the spirit in which these architectural guidelines have been prepared. They reflect neither too specific customer needs, nor particular design concepts ; moreover, they take into account the availability of products on the market. This is an additional reason why the guidelines themselves are under constant review and correction, and why some important subjects are not included when the standardisation process does not point to general and common sense solutions. In the next edition of the guidelines a more advanced analysis of some of these subjects will be covered, such as:

* Introduction of ISDN and final selection of LAN standards ;
* Network management and addressing scheme
* Encryption ;
* Integration of servers ;
* User interface standardisation ;
* Document management.

The Commission of the European Communities would be grateful to receive information and suggestions for the next edition of these guidelines at the following address, where also extra copies of this document can be ordered.

COMMISSION OF THE EUROPEAN COMMUNITIES
Directorate of Informatics
Jean Monnet Building - Room C2-84
L-2920 LUXEMBOURG

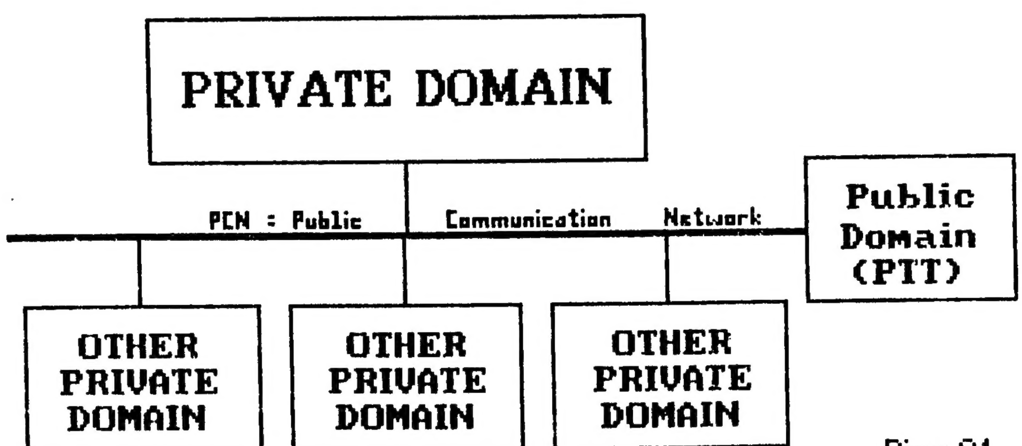
2. ARCHITECTURE

2.1 Structuring

The aim of the architecture is to fulfil the objectives stated in the introduction and allow the integration of data, text, graphics, image, voice, etc.; it is an open architecture.

To the end user, the architecture appears as services delivered via a single workstation. Some important services, to which attention will need to be paid in the 1986-1991 period, are : user agent services, information production and administration, information dissemination service, electronic mail, and application services.

User populations of autonomous organisations, such as private companies, government administrations and European Institutions, have independent informatics management structures. Following the CCITT (1) terminology, they will be called Private Domains. Private domains will communicate via Public Communication Networks (PCN) and use services delivered by Public Domains, which are managed by public telecommunication administrations (PTTs).



Diag.01

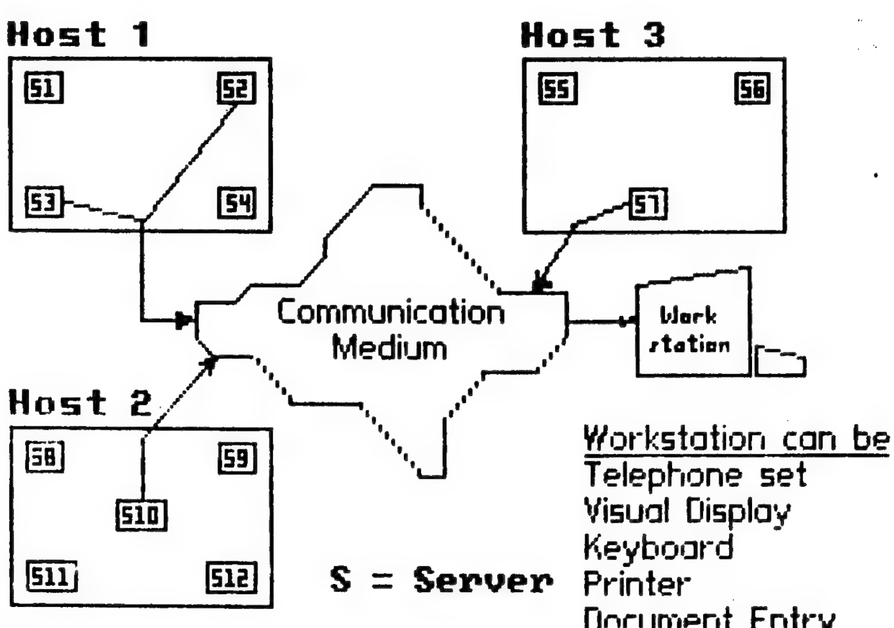
(1) CCITT = International Telegraph and Telephone Consultative Committee

The distinction between public and private domains implies a distinction between an **inter-** and **intra-domain** architecture. The first has to be determined by common agreement between all domains concerned. The management of each domain is autonomous in determining its intra-domain architecture. The definition of the intra-domain architecture, however, is significant if end-user interworking across domains is to be achieved.

The intra-domain architecture of the CEC is based on distributed processing. Services are provided by means of hardware, software, networks, and support (the **infrastructure**).

The user accesses the architecture through a **workstation**. A workstation may be a telephone set, visual display, keyboard, printer, document entry station, etc. Ideally, the user should need just a single multi-function workstation to access all available services. How services are obtained beyond the workstation should be transparent.

The workstation communicates with hosts distributed in the network. A **host** is a computer with its operating system and its communication interfaces. It provides the host environment for a set of servers. A server is a software package and the resources it draws from its host. In order to deliver a service to the user, (such as access to data bases, electronic mail, information production, document management and application services), it is necessary to set up a flow of communication between cooperating servers which together produce the service (*)



Diag.02

(*) The term "service" in this document means "service to the user", and does not refer to the service that exists between the layers of the OSI model.

In order to cope with all possible combinations of hosts and servers, which may occur in the course of time, it must be technically possible for any server to communicate with any other server. This implies the principle of **Open System Interconnection** (OSI) and the implementation of the related standards (see § 3.2)

However, OSI is only a means to the end of constructing a good architecture. The architecture itself is the structure of the solution to the needs of the users and must define :

- how services are set up by cooperating servers
- how servers are mapped onto hosts
- how hosts are distributed into the network.

To answer these questions, the distinction between "host" and "server" made above is of material importance.

The architecture consists of rules for structuring ; not rigid pre-defined structures. The rules themselves will change in the course of both technical evolution, and eventual changes in the users' pattern of behaviour. The rules are dictated by the technical, functional, and economical relationships between technology on the one hand, and user activity on the other. The resulting architecture must, at any one time :

- Fit the organisational structure of user populations, resulting in unambiguous relationships regarding responsibility and management of the use of informatics.

- Fit the operational structure of user populations, resulting in an easier flow of information.

- Effect the match between the users' needs and the resources to fulfil them in an economical manner.

2.2 Distribution of Hosts

The basic organisational entity is the **Local User Community**. It must have a close working relationship and be characterised by intensive interworking and a common requirement for specific sets of services. This should justify the cost of providing local support and management.

From both an organisational and operational point of view, there is a requirement that this local support and management should cover :

- The administration of equipment (including hardware, software, data and local communications) ;

- The control of access to these resources from both the economical and security points of view, including identification, authentication and addressing of users.

A local user community will generally coincide with an organisational unit such as a department within a single site. "Site" is not necessarily the same as "building". There may be more than one site within a building, or there may exist links between buildings to enable treatment as an unit.

The hardware, software and support which is dedicated to a local user community is called a **Local Support Unit (LSU)** and it is put under the operational supervision of a **Local Systems Administrator (LSA)**.

A LSU should serve as large a user community as possible. If, however, a user community is divided geographically in a manner that cannot be supported economically by a single LSU, it should be served by different LSUs. Similarly, if a large user community consists of groups carrying out activities with little or no interaction, it should be served by different LSUs.

As an LSU is thus an autonomous unit, whose physical separation enhances its security.

An LSU is composed of **local hosts, personal hosts** and **workstations** with the necessary servers. A personal host is dedicated to a single user at a time and therefore is, in principle, built into a self-contained workstation, such as a personal computer (PC).

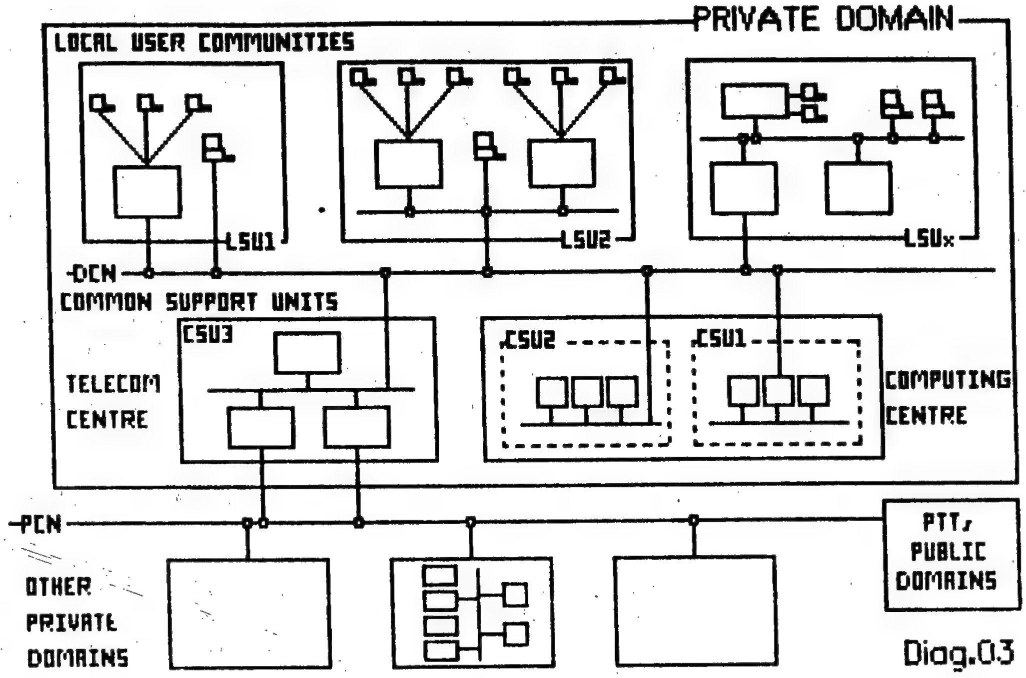
The resources within an LSU are interconnected through a **Local Communications Network (LCN)**. As the LSU itself, an LCN is a conceptual/organisational link between resources and does not imply a specific technology. It can be implemented through various technologies such as asynchronous communications, a packet switching network, or a Local Area Network (LAN). The term LAN whenever encountered in this document does not refer to the LCN, but to a specific technology through which it is implemented.

Hosts which, for whatever reason, are not part of an LSU, but deliver services to families of LSUs, to the entire private domain in which they operate, or to other private domains, are called **common hosts**. They constitute **Common Support Units (CSU)** under the operational supervision of **Common Systems Administrators (CSA)**.

The geographical location of CSUs is generally remote from the LSUs. They are concentrated in **Computer Centres** or in **Telecommunication Centres**.

LSUs and CSUs are interconnected by a **Domain Communication Network (DCN)** while interdomain communication uses the **Public Communication Networks (PCN)**.

The relationship between the support units of a domain, and the inter-domain relationships are shown in the next diagram :



Diag.03

The two level architecture of LSUs and CSUs is intended for large and geographically spread organisations. Small organisations located in one building are suggested to follow an architecture similar to a that of single LSU. A gateway to the public networks could then contain a mini telecommunication centre.

Other deviations from the general model may occur when members of a local user community are not in the same office area but at a larger distance. If this is an exception, a pragmatic ad-hoc solution must be found without changing the architecture guidelines. There are cases, however, where user communities are spread over different countries (e.g. international committees), or even composed of mobile members (e.g. members of the European Parliament).

Two solutions are then recommended :

- If there can exist, somewhere, administrative and/or secretarial support for the community, this can be organised as an LSU providing a service access point. The distant workstations, preferably personal computers, are then connected by the inter- and intra-domain communication networks to the LSU from where all the services for the local community can be accessed ;

- If such a service entry point cannot be provided, each member is then equipped with a "single workstation LSU", again based on a personal computer, but even, in some cases, simply with a terminal linked to the Videotex services provided by the national PTTs ; the latter provides almost a "unidirectional" LSU. In this solution, isolated autonomous users are considered as single member communities.

2.3 Distribution of Servers

Servers can be classified in different categories :

- a **personal server** can be allocated to a single user

- a **local** server cannot be allocated to a single user because its services are, by definition, to be shared by the members of a local user community (e.g. departmental data)

- a **common server** cannot be allocated to a local user community because its services are, by definition, to be shared by several local user communities, the whole domain, and possibly user communities outside the domain.

- an **external server**, by definition, has to be accessed through inter-domain communication.

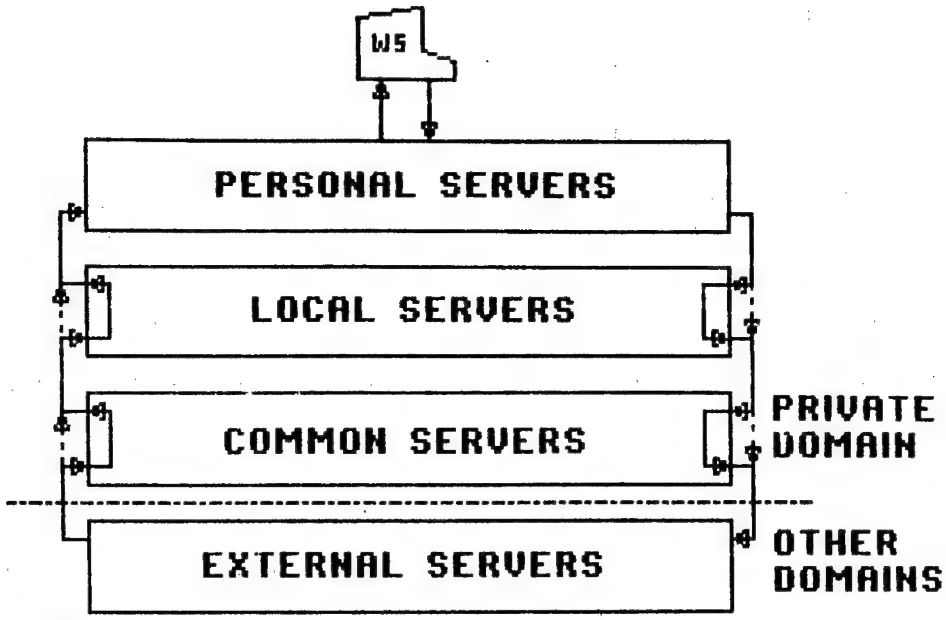
In general, the distribution of servers follows the pattern of distribution of data.

It seems logical to locate personal, local and common servers on personal, local and common hosts respectively. For diminishing technical and economical reasons, servers are often installed further upstream from the user ; in the past, all servers were located on a common central computer.

It is therefore possible that text and graphical processing are still provided by local and even common hosts, and that local applications, including local data bases, are run on common hosts. This would be the exception rather than the rule. Heavy batch processing and number crunching will continue on large mainframes for economical reasons.

It is technically feasible to locate servers downstream from their normal position and place common servers on local hosts. This would be undesirable, for purely organisational reasons : to migrate from a centralised way of using informatics to one in which any user community can provide services to any other is associated with problems of security, responsibility and resource management. Such an approach is, therefore, in contradiction with the organisational principles of the architecture, stating that only CSUs have the mission of a domain wide coverage of services.

Although it should be technically possible for any server to communicate with any other server (see dotted lines on next diagram), the architecture must also foresee features allowing or obliging the user to call upon a local server before accessing a common server, or a common server before accessing an external one. This will assure compatibility bridging, added value operations, security and better administration and control. Local and common hosts and servers must, therefore, provide adequate pass-through facilities.



Diag.04

In summary, servers are the resources in operational form. They have to respond directly to user requirements ; their operation must follow the organisational structure of the users.

The mapping of personal, local and central servers on personal, local and central hosts should follow the dictates of economics. If it were ever necessary to map a personal server on a central host, this would be for economical, and not technical or organisational considerations.

Such mapping as there may be should, as much as possible, be transparent and convenient to the end user. Hence, an emphasis on "pass-through" facilities enable different hosts, and through them servers, to be accessed from a single workstation.

2.4 Constraints

The planned architecture cannot be achieved overnight because :

* Many of the standards necessary for fully open systems do not exist yet, especially in the higher levels of the OSI model.

* The state of the art of integration is not mature enough for the implementation of the architecture. Industry progresses slowly and in different directions in the development of standard products. The PTTs have not progressed enough in the consistent implementation of their own standards at the European level.

* The shift from central to local processing and from domain to local communications should not take place at a faster rate than can be economically justified. An economical balance must be struck between the rate of decrease in local hardware costs, the cost of new software, and the need to avoid chronic congestion of the CSUs and the DCN.

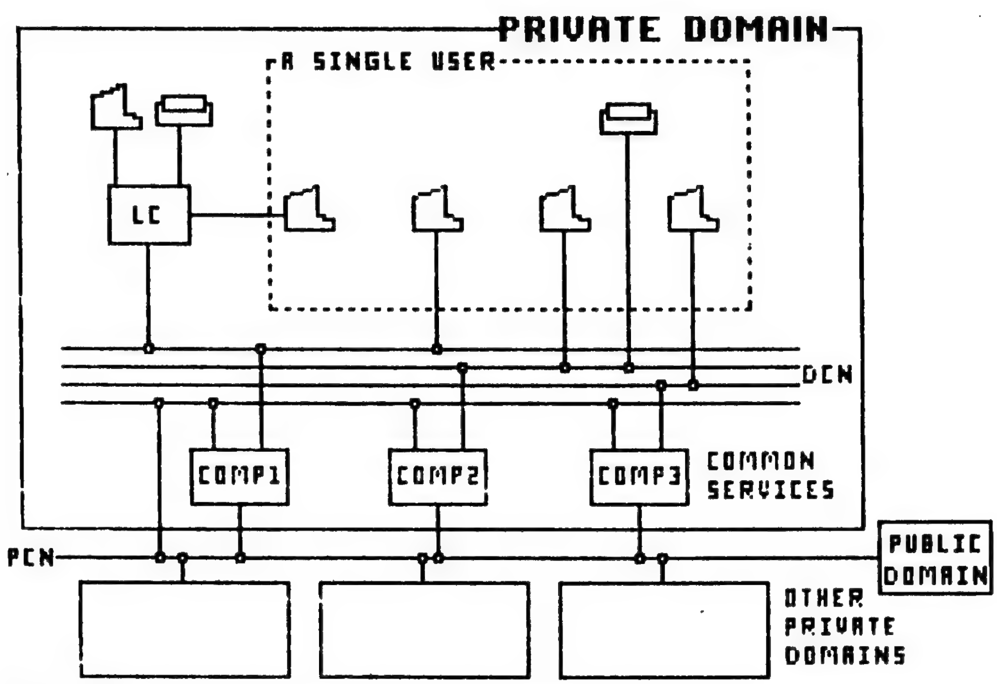
* The economical life cycle of existing equipment must be taken into account for its economical replacement.

* The training needed to implement the plan is considerable. It can only be carried out over some time ; especially as not all users have the same degree of motivation.

A gradual attainment of the goal is necessary. The speed of evolution will depend on the factors mentioned above, as well as on technological development.

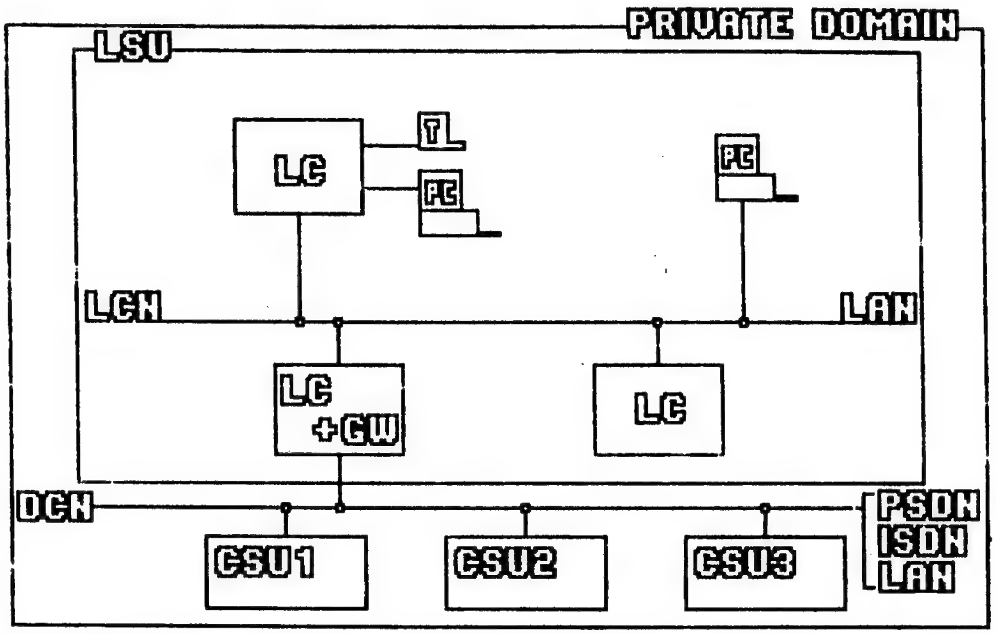
2.5 Evolution

In the past, central hosts from different manufacturers generated separate networks of terminals and remote job entry points through proprietory communication methods. There was little interconnection between equipment from different "empires". This is shown in the diagram below :



Diag.05

The diagram that follows shows the principles of implementation of the organisation shown in section 2.2.



Diag.06

This diagram shows an aim to carry out communication between domains primarily through the Integrated Service Data Network (ISDN). At the local level, the equipment of an LSU is connected through the local communication network, implemented as a Local Area Network (LAN).

The transition from the past architecture (fig.05) to the future one (fig.06) must be carried out in steps forming an evolution which takes into account the constraints explained in section 2.4. The implementation of these steps is the following (with the CEC plan shown in brackets) :

- Replacement of proprietory terminals by multi-protocol terminals (84-86)
- Expansion of local computers supporting standard terminal and personal computer connections with pass-through to CSU's (83-90)
- Introduction of multi-vendor operating systems for LSUs (UNIX and MS-DOS) (84-90)

- Introduction of packet switching data network for DCN and LCN communication (85), and phasing out of binary synchronous communication (85-87)

- Installation of multi-vendor file and job transfer (1983-1987)

- Installation of software products (e.g. DBMS) covering as many CSU-mainframes as possible (84-87)

- Selection of office and professional software products for selected operating systems creating a common end-user environment (85-87)

- Phasing out of stand-alone text processors to be replaced by personal computers supporting equivalent text processing functions (86-90)

- Implementation of electronic mail services (86-90)

- Construction of Telecommunication Centre (87-88)

- Introduction of standard LAN-technology for LCNs in order to off-load the PSDN and assure integration and resource sharing of LSU equipment (87-90)

- High speed interconnection of computer centre mainframes (88)

- Introduction of User Agent Services (see 5.1) and Information Dissemination Services (see 5.3) (87-89)

- Replacement of DCN telephone and packet switching data network by ISDN (1991 and beyond)

3. STANDARDS

3.1 Interworking

The ability of users in different domains to interwork is an important aim of the architecture. Standards are essential for integration of data, text, graphics, image, voice, etc. in an interworking environment, and condition the decisions on the structure of the proposed architecture.

There exist the following problems :

* Complete and option free sets of interrelated standards must be available to implement end-to-end interworking.

  The development of international standards has not reached this state of completeness, especially in the upper layers of the OSI model.

  The Functional Standard Profiles brought forward by CEN/CENELEC/CEPT and the industry are the appropriate solution to this problem. They will be adhered to completely, as well as the European standards resulting from them (EN).

* In order to turn a paper standard into a de-facto standard, it is necessary that it should be implemented on the market place as dictated by market forces.

* When a product claims compliance with a standard, there must exist a means of testing this claim. The creation of Conformance Testing Centres (CTCs) is an important element in this and will be used for testing such compliance.

The following elements of standardisation play an important role in the implementation of the proposed architecture :

- Open Systems Interconnection (OSI)
- Transportability of Software
- Human Interworking
- Security and Resource Management

3.2 Open Systems Interconnection - (OSI)

The OSI principle will be applied throughout. This is a recommendation from the International Standards Organisation (ISO), laying out the guidelines for a layered model of communication. It must be interpreted compatibly in the creation of different standards.

The layers on which international agreement has been reached, allow equipment to intercommunicate but not to interwork. The following rules are laid out in the context of an intercept strategy :

* The implementation of international standards becomes mandatory as soon as commercially available products make it feasible.

* Protocols corresponding to OSI levels, for which an international standard is not ratified, will be implemented with intercept standards. There is an urgent need for a full set of intercepts to be completed, especially for the upper layers.

3.3 Transportability of Servers and Operating Systems

To benefit from independence from individual manufacturers, it should be possible to place the same servers on different hosts. Thus :

* Conversion and disturbance costs are reduced when changing computers, especially as their product life-span has become much shorter than that of software ;

* Application servers can be shared ;

* Training and staff costs are reduced ;

Transportable, manufacturer-independent, operating systems have been maturing in recent years. These provide the conditions for the development of commonly supported software, by enlarging the size of the market for any one product.

Commonly available operating systems should be de-facto standards as long as no application interface standards exist.

3.4 Human Interworking

Interworking, as understood by the user, involves a broader environment than OSI and portability. Integration through "user" standards is needed in areas such as :

* Common command and access procedures
* Common terminology
* Common definition of office procedures

The issues arising out of these requirements are discussed further in chapter 5 of this report.

3.5 Security and Resource Management

More users can access a single host or server through a network than ever before ; the identity of these users is not always easy to establish.

Economical use of resources, priority settlement, and control of usage to avoid congestion, overload, and degradation of quality of service have become major issues of concern.

These are not communication problems, but ones of security and management of resources. There are very few standards in these areas and their promulgation is urgent. They should cover identification and authentication procedures for people and equipment, encryption, access control, accounting, and implementation of rules of internal control.

4. IMPLEMENTATION OF THE ARCHITECTURE

4.1 Implementation Strategy

To implement the architecture in a gradual and coherent manner, a strategy, ensuring that standards are not only created but also encouraged in their implementation and adhered to in the use of informatics, is needed. This has the following elements :

* **The process of standards making and intercepting ought to be** accelerated. This is recognised by the CEC, the Member States and industry alike, and the effort put in the SOGT-CEPT and SOGITS-CEN/CENELEC should be followed closely.

  The priorities must be defined in line with the customer implementation problems, which are in the first instance the phasing out of proprietory protocols for remote interactive communication, file transfer and message handling, as well as the creation of stable application interfaces.

* **The cooperation of vendors** of different informatics products and services with each other as well as with the CEC ought to continue and be extended in new areas to ensure that standard solutions to problems are furnished, and that any adaptations in existing products are made available to the whole market.

  The present guidelines provide valuable information for industry on the critical problems a customer meets when implementing a multi-vendor standards policy.

* The **cooperation of the PTTs** must be ensured in permitting identical implementations of standards in different public domains. Without this, inter-domain interworking will be hampered by inefficiency and high costs of communication, even in the most standardised intra-domain solutions.

* **Cooperation between the European Institutions and the Administrations of the Member States** should continue with common projects such as INSIS and CADDIA, and even enhanced, to achieve the level of agreement and standardisation necessary for inter-domain communication. This is important, given that integration will not take place on a separate

network alongside the national ones, but at the level of the national networks. It will convert the intercommunication to be achieved in cooperation with the PTTs to interworking between domains.

* The European Institutions and the Administrations of the Member States can state their requirements through their role as "clients" of information technology. The establishment of a **procurement policy based on common procurement specifications** has a very positive role to play, and the role of the Standards Implementation Committee (SIC) in promoting the architecture is a key one, ensuring that compatible options are selected and that testing compliance of products is feasible.

* The resources, hardware and software, which, for the components of the proposed architecture, are obtained through **calls for tender**. These will insist on adherence to common procurement specifications. **A simplified** and well publicised tendering procedure will be adopted, able to be carried out on an almost permanent basis. This will allow :

  - Evenly spread workload in updating procurement specifications ;
  - Possibility of new products, improving the architecture, to be considered as soon as they are available on the market ;
  - Reduction of tender preparation workload for the suppliers ;
  - Simplified screening of products and evenly spread workload in testing them ;
  - High visibility of procurement policy and implementation of standards, both for the suppliers and the Administrations of the Member States ;
  - Advance information on requirements which become mandatory for future calls for tender.

* The end users of informatics **must be aware of the strategy adopted**. To encourage the adoption of this strategy in user communities, **guidelines for the use of hardware and software** have been prepared. These define the categories of products in terms of the support that will be provided to them, and give preference to those products that enhance the strategy, while making allowance for special cases and for a smooth transition period.

* **Equipment which does not comply with the architecture will be phased out** as its useful life ends, to be replaced with standard equipment. Only this way will cycles of dependency be avoided, which may otherwise perpetuate the presence of non-standard solutions.

4.2 Inter-Domain Communication

The responsible organisation of each domain has to manage a planned evolution towards the intra-domain architecture of its choice and design. The CEC implementation is described in sections 4.3 to 4.5, and in section 5 for different services.

To realise inter-domain interworking, a compatible evolution of the intra-domain architectures is necessary. To achieve this compatibility, there is a need not only for standards to be defined, but also for users, the hardware and software industries, and the PTTs to comply with them. In particular, the PTTs must make the services based on these standards available, notably :

- Leased lines
- Data networks
- Telex and Teletex
- Public Electronic Mail
- Videotex Services
- Teleconferencing

It is proposed to use the most advanced public services for inter-domain communication on condition that harmonised implementation throughout Europe is available within the required time-frame. Where this is not the case, the same service will have to be organised by direct inter-domain cooperation of telecommunications centres using public data networks or leased lines. For such cases, the CEC proposes to its partners the same standards implementation for inter-domain communication as it has adopted for intra-domain LSU/CSU communication (see section 4.3 and section 5).

In the organisation of inter-domain communication, telecommunication centres (see § 4.3) play an essential role. Consequently, telecommunication domain managers should meet to agree on common conventions and to prepare a common customer position with respect to public services.

4.3 Intra-Domain Communication

In this section, the three entities that provide the interconnection of equipment within a domain are considered :

* The Domain Communication Network (DCN) which links the LSUs and the CSUs,
* The Local Communication Network (LCN) which links the equipment of an LSU,
* The Telecommunications Centres which oversee communications on the DCN and provide a gateway between the DCN and the public networks, or the networks of other domains.

In addition to interconnection, the principles of information exchange are considered in this section consisting of :

* Remote Interactive Communication and
* File and Job Transfer.

User services will be discussed in section 5. A more detailed discussion of the standards profiles adopted is given in the annex.

To provide the connections necessary, both the DCN and the LCN will use different, but coexisting, communication technologies for some time.

The **Domain Communication Network (DCN)** must eventually achieve integration with the ISDN (Integrated Services Data Network). Before this integration, it will use a PSDN (Packet Switched Data Network), the private CSTN (Circuit Switched Telephone Network), leased lines and, possibly, LAN technology for single large buildings.

Within the **Local Communication Network (LCN)**, the evolutionary introduction of coexisting technologies will ensure workstation and interhost communication. This will start with direct connections of terminals to local hosts, continue with interhost connections by the PSDN, and finally end up with LAN technology and pre-ISDN digital exchanges.

Except for urgent cases, the general introduction of LAN-technology will be based on a competitive range of products supporting international standards. The first implementation of LAN will be using Ethernet technology because this is the most widely spread to date, and well supported by CEN/CENELEC functional standards profiles. This does not include cheap LAN products with V24 interface for workstation to local host communications.

Remote interactive communication lags far behind other fields in standardisation. The long awaited ISO Virtual Terminal Protocols are far from approaching definition, and seem to pursue a moving target. At the same time, an important class of commercially available terminals is sufficiently close to conformance with a subset of existing ISO standards. It is thus important that the standards' committees decide on an intermediate standard subset which is close to general current practice ; otherwise software suppliers will continue to develop products interfacing with proprietary protocols and hardware suppliers will keep their customers captive to their product range. This is yet another example from a class of interconnected standardisation issues for which if no solution is found soon, the overall purpose of the standardisation process is put at risk.

A proposal of a feasible approach is explained in the annex. Until a solution is found, ad-hoc and awkward solutions in the form of multiprotocol converters are forced upon the architecture (see section 4.4) which must only be temporary.

File and Job Transfer between different computers in the Commission has become an urgent user need. As a result, the **Multilateral File Transfer System (MFTS)** has been developed with references to NIFTP and ECMA standards on X.25 networks.

MFTS is available on BS2000 (Siemens), VME (ICL) and MS-DOS computers. MFTS will be available on UNIX-V in early 1987, on MVS (compat.IBM) in mid-1987 and on GCOS-8 (BULL) in 1988.

MFTS will be replaced by ISO-FTAM (File Transfer, Access & Management) and by ISO-JTM (Job Transfer & Manipulation) as soon as these standards are available in products.

The functionality of MFTS, FTAM, and JTM is as follows :

	MFTS	FTAM	JTM
* File Transfer & Management	X	X	
* Hierarchically structured files		X	
* File Access		X	
* Binary Files	X	X	
* Remote Job execution	X		X
* Remote printing	X		X

Telecommunication Centres (TC) have, as their primary role, to provide central services and, possibly, control over communications oriented operations. The precise definition of the functions of the TCs after the introduction of ISDN is beyond the time horizon of this document. They may include such functions as:

- Communication servers for the Domain Communication Network, such as for electronic mail (see section 5.4)
- Gateways between the DCN and the public communication networks (PCN)
- An integration between different communication carriers until such time as a proper integrated service can be implemented (ISDN)
- Network management servers
- Ante servers (see section 5.1).

Telecommunications centers will use computers with fast processing capacity for filtering, fast temporary storage (buffering) and less emphasis on long term mass storage capacity.

4.4 Local Support Units

Conformant to the policy of prefering products which enhance the transportability of servers, is a decision to limit proprietory operating systems , and not to introduce new ones unless they are generally available on equipment of several manufacturers. Of such operating systems, MS-DOS and UNIX have been selected ; the former for single user hosts (workstations), and the latter for single - and multi- user hosts.

In the case of UNIX, portability is further enhanced by the formation of the X/OPEN group of manufacturers specifying a standard definition of the interface to the UNIX operating system . As this standardised interface is primarily to ensure the portability of applications, preference is given to softwares whose interface with the host environment conforms to that defined by the X/OPEN specifications. Cooperation will allow the definitions to be extended to new pertinent areas such as the support of extended multi-lingual character sets.

This is expected to have a profound effect on the configuration of LSU resources, as they will for their greatest part consist of new installations. However, this policy does not preclude the installation on non-UNIX systems on LSUs. Non-UNIX systems will continue to be installed as long a continuity needs to be preserved with existing servers based on proprietory operating systems.

Selection of software has a much more important impact on hardware selection than it has ever had in the past. Software packages can contribute to a drastic decrease in the cost of developing complete applications and acceleration of their use is economically expedient. Such packages should be available on as many systems as possible.

A coherent set of software products that should be selected for the LSUs should provide servers for the following functions :

- Ante-Server (see section 5.1)
- Text processing
- Data Entry
- File Server
- Structured Data Bases
- Document Otat Bases
- VTX Data Bases
- Thesaurus
- Data Dictionary
- Print Servers
- Report Writer
- Mail Server
- Business Graphics
- Advanced Graphics
- Cartography
- Document Composition
- Statistics
- Spreadsheet
- Desktop
- Compilers/Interpreters
- Screen Formatting
- etc...

To economise on the human resources required for training and user support, it is necessary to limit unnecessary redundancy in the packages to fulfill these functions. Equipment that cannot support selected packages, therefore, stands a smaller chance of being acceptable, despite its intrinsic merits as a product.

The tasks that need to be carried out within a local user community should be appropriately distributed between local and personal computers : the higher the requirement from a server interactivity and immediate response, the more it ought to reside on a personal host ; requirements of common access to data, on the other hand, will dictate the location of a server on a local host.

For the user to feel at home independently of the host, or even the software being used, standardisation of the user interfaces is important, whenever possible, in different classes of application. Thus :

- SQL is adopted as the standard interface to relational databases ;
- CCL for documentary databases, enhanced by a system of menus ;

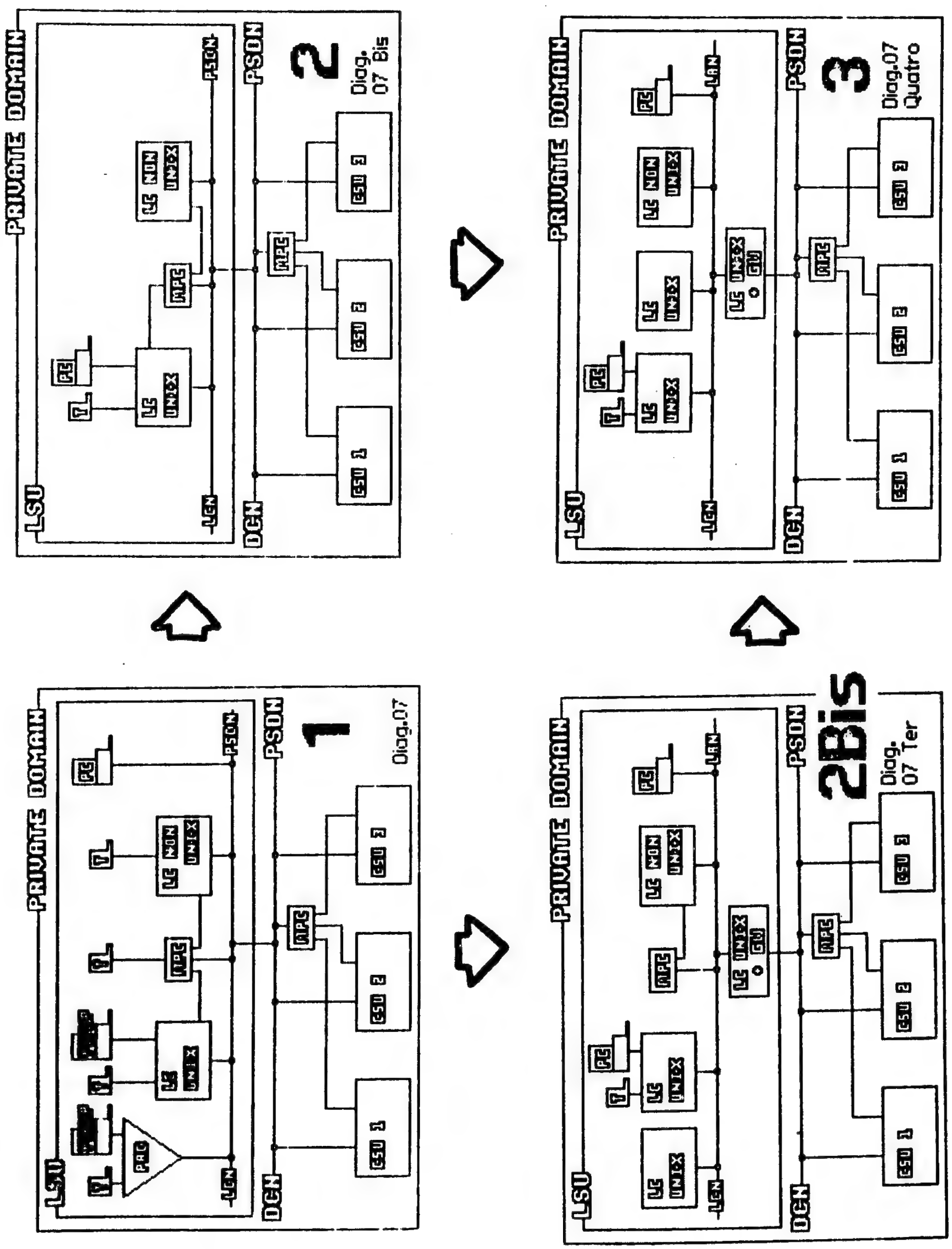
It would be desirable to adopt such widely acceptable interfaces in the areas of graphics, and end-user programming languages. APL is widely used as an end-user programming language, but it is not suitable for all purposes; at the same time, 4th Generation Languages are too new to have established themselves, let alone be moving towards standard interfaces.

The end user should also have available the means of printing close to the workstation, at least for draft quality printing. Higher quality printing will generally be available through printer servers residing on local hosts.

Necessary conditions to reach the desired target are :

- the removal of proprietory terminals, permitting the principles of a single integrated workstation to be implemented in a standard way (see Annex)
- the introduction of cost effective technology for the efficient implementation of the LCN.

This is achieved through the steps shown in Fig.07 to Fig.07 quatro below :



* **Fig. 07 :** **In the short term, a proprietory multi-protocol converter (MPC) installed at the CSU and LSU levels will permit the connection of standard terminals to the CSU hosts, to UNIX and non-UNIX hosts. For the connection of workstations to hosts within an LSU, cheap LANs based on V24 interfaces may also be used.**

* **Fig. 07 bis :** As equipment is phased out the following changes take place:

  - PADs disappear with terminals accessing the DCN via the UNIX computers ;
  - Word processing equipment is replaced by PCs ;
  - Access to non-UNIX computers in an LSU is carried out entirely through PCs or standard terminals ;
  - PCs cease to be connected directly to the PSDN, MFTS being available on UNIX.

* **Fig. 07 ter :** LANs are introduced resulting in :

  - UNIX local computers without workstations.
  - The connection of PCs on the LAN for sharing resources
  - The MPC becomes a server with a standard interface towards the LAN and a proprietory interface towards the non-UNIX local computer
  - A gateway between the LCN and the DCN is introduced.

* **Fig. 07 quatro :** The target is reached, and the MPCs removed, once a functional standard exists and is implemented for the connection of standard terminals to the non-UNIX local computers.

The importance of pass-through facilities cannot be over-emphasised.

4.5 Common Support Units

The components through which a Common Support Unit provides its services are mostly large computer hosts with fast processors and substantial storage capacity for central databases, as well as appropriate channels of communication.

There are two main types of CSU :

- Computer Centres
- Telecommunication Centres (see 4.3).

Many heterogeneous systems are likely to be present for the foreseeable future of mainframe installations across, as well as within domains. The disadvantage of heterogeneity is reduced (whether the user is in the same domain or not) by:

- Adoption of "standard" application software on as many installations as possible providing the user with a consistent interface ;

- Adoption of standard intra-domain communication on all installations, as explained in section 4.3 and 4.4 fig 07 ;

- A high speed channel connecting processors and allowing the resources of one computer to be accessed via another one.

In the CEC, the following mainframe operating systems will be supported by the intra-domain communication explained in 4.3 :

ICI	:	VME
SIEMENS	:	BS 2000
IBM	:	VM/CMS on AMDAHL
IBM	:	MVS on AMDAHL
BULL	:	GCOS8

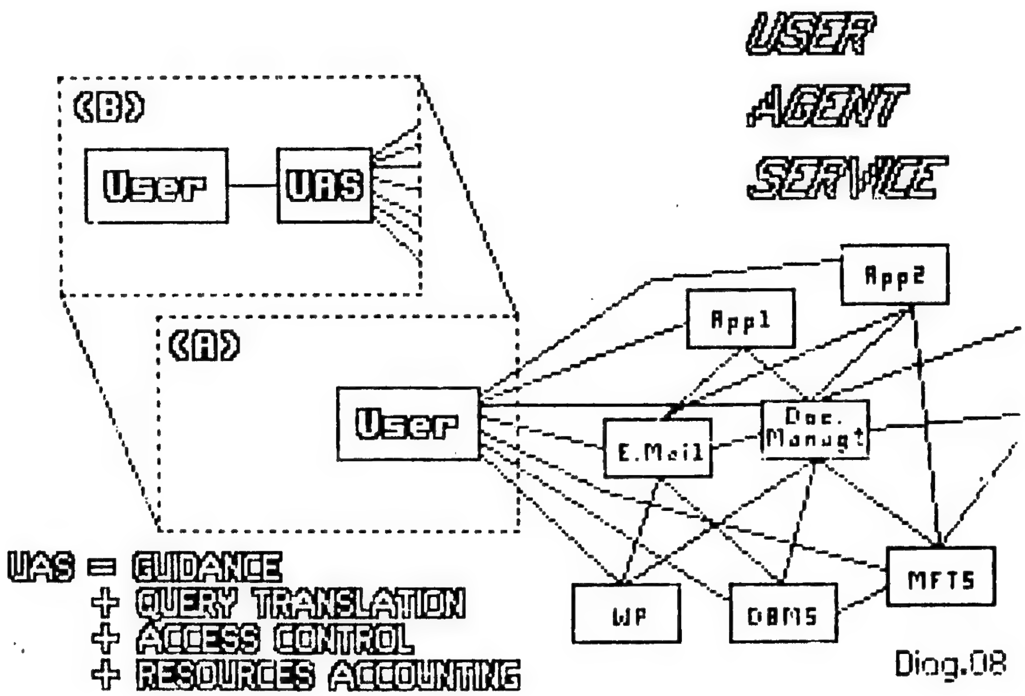
The most important general application software for which maximum coverage is persued in the CEC includes : ADABAS/NATURAL-SAS - MISTRAL-BASIS. Videotex type servers will be added as soon as selection procedures are completed.
Standard user interfaces implementing CCL (Common Command Language), SQL and menu driven access will be generalized for all textual and numerical data base systems.

For the future, the main mission of the Computer Centre will be to set up and operate the infrastructure for an Information Dissemination Service (IDS - see section 5.3).

5. IMPLEMENTATION OF SERVICES

5.1 User Agent Service (UAS)

A user of the informatics architecture generally accesses servers and interacts with them. In so doing, the user is faced with a formidable array of interfaces as shown in the diagram below (User A) :



Diag.08

This complexity does not need to be that high because the choices of the user at any one time are generally limited to those of the object at hand ; for example, access to a database for information on a particular subject : the user does not know on which host the information he is interested in resides, nor does he remember the procedures necessary to log into the appropriate one.

To simplify the user interface, there will exist **a User Agent Service (UAS)** which will act as an "agent of the user" vis-à-vis the appropriate servers.

These servers may reside on different heterogeneous hosts which may belong to different domains.

The User Agent Service is implemented through ante-servers (AS). An ante-server is a piece of software which interacts with the user, and acts on the user's behalf in interacting with the appropriate target servers.

The ante-server, therefore :

- Gives the user guidance in finding the location of the appropriate service;

- Acts on the user's behalf to establish an appropriate connection and, possibly, provide translation services in formulating the user's query in terms that the entry server will understand ;

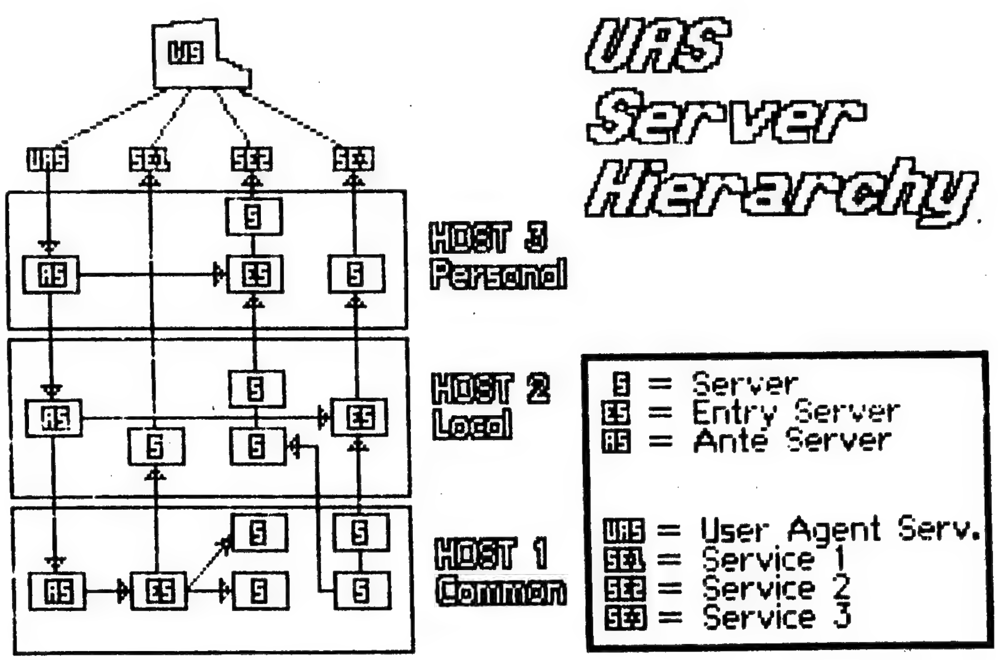
- Provides access control to services (identification/authentication) ;

- Collects service accounting data of the resources used.

An ante-server behaves, with respect to a target service, as if it were the user. The other servers it interacts with are not aware of its existence. Thus, the ante-server can be the user of another ante-server, and of course have other ante-servers as users. We can, therefore, distinguish a hierarchy of ante-servers as follows :

- Common ante-servers
- Local ante-servers
- Personal ante-servers

This hierarchy is shown in the example diagram below :



Diag.09

In this diagram, the user interacts with an ante-server (AS) on the host on which he/she is immediately connected. Through a cooperation of possibly many ASs, "entry servers" (ESs) are accessed on the appropriate hosts. These may be the target servers or they may invoke other directly cooperating servers on the same or different hosts providing, in the example above, three services (SE1 to SE3).

The personal ante-server is likely to exist if only to limit the choices available to the user, for example by effecting a direct connection with a local ante-server.

Access control and accounting will, of course, be more developed for the common ante-servers.

A central ante-server with dedicated host will be part of the Telecommunication Centre and will manage the intra- and inter-domain connection calls to all other ante-servers.

To achieve the desired tasks, an ante-server will have access to :

- Information on users (user profiles) relating to access control and technical competence,
- Information on the target servers and their environment.

These will be stored in databases describing services and users which will be available to the administrator of the User Agent Service.

User Agent Services must be accessible by standard screen mode terminals.

5.2 Information Production and Administration

These are the services which :

- Help the user produce information for his/her own use, or for use by others. Production can be original (e.g. text processing), or it can consist of the modification of existing information to produce new information (decision support systems, the information necessary to update a data base, etc.).

- Help management to administer the information produced by registering the information produced (such as documents) with unambiguous identifiers, relating it to other items of information for easier future retrieval and follow up of actions.

For the production and administration of information, the data are stored in a production data base. The resources take the form of processing and storage capacity through servers on any type of hosts.

Depending on whether the user maintaining and accessing the information is the individual user; the local user community or a group spread over different local user communities, the production data base will be personal, local or common.

For personal and local production data bases, the Local Support Unit will provide the necessary resources (see section 4.4). Common rules for office procedures, document administration, terminology and office document architecture (ODA) must assure communication of information between local user communities.

Common production data bases are maintained in the Computer Centre (see section 4.5). An important special case is the central archiving of non-active local information that has to be maintained for the whole organisation.

5.3 Information Dissemination Service (IDS)

Numerous databases currently exist in the European Institutions, containing large amounts of information. The potential usefulness of this information is not fully exploited because :

- Access procedures are difficult ;
- Retrieval languages are difficult to use and vary from one system to another ;
- Data bases are designed to fit local and limited usage. They are production data bases rather than dissemination data bases ;
- Information about existing information is insufficient.

To overcome this barrier, new data bases will be created whose aim will be to give easy access to the information needed by a specific user group. Such systems are called dissemination data bases (DDB). They must appear to the end user as a single data base, even if different DBMS and different data bases are used to satisfy the needs of a user group. The content of dissemination data bases is built up of extracts from production or other dissemination data bases. Common DDB are, by definition, located on CSU's (Computer Centre).

An Information Dissemination Service (IDS) is a service which presents a set of tools and an organisational framework for the creation, maintenance and interrogation of dissemination data bases. IDS offers :

- standard data base formats for specific types of information : for example, standard descriptions and/or presentation for bibliographic information - likewise for statistical, legal and terminological information ;
- standard facilities to feed the DDB. These include interfaces between production and dissemination databases, interfaces between DDS and other data sources, such as Telex/Teletex, text processing or photocomposition tapes, and direct data entry ;
- a user-friendly interface for information access and manipulation, explaining itself and adaptable to specific user needs. The interface is not limited to a single data base, but includes all databases of interest to a user group. It should be harmonised with the UAS user interface ;

- interfaces and tools to produce extracts of data bases on magnetic tapes, read-only optical disk media (CD-ROM), micro-fiche or paper, or to down-load data onto a local computer, and distribute documents by electronic mail ;

- facilities describing the information that is available.

Defining and implementing standards is an essential element within IDS and is required at three levels :

- Standards for the structuring of information. A homogeneous user interface and automatic data exchange are impossible without standard rules for information structuring and formatting. Examples of existing standards are CCF, UNISIST and FORMEX.

- Exchange standards are to be based on more technical standards which do not describe the content of the information, but only the technical format. For example, the representation of documents containing an unlimited number of variable length fields is defined in ISO 2709. The implementation of such standards will decrease the effort of developing specific interfaces considerably.

- Standards for a unique presentation of screens and menus. Although different data management software might be used for a single DDB, the system should appear to be based on a single homogeneous software system. Standard rules for dialogue and screen design must thus be applied to all sub-systems of IDS as well as to UAS and possibly to other services having a large user population.

5.4 Electronic Mail

Electronic Mail should allow messages (documents) of various formats to be interchanged between users in the same domain, as well as between users in different domains, including ones outside the European Institutions.

Electronic Mail will be based on the Message Handling System standards, as developed by the CCITT and ISO (MHS/MOTIS).

Until such time as MHS products are available on the hosts selected for the present architecture, electronic mail will be based on Teletex protocols supplemented with a message header, derived from and equivalent in scope to the CCITT X-430 recommandations.

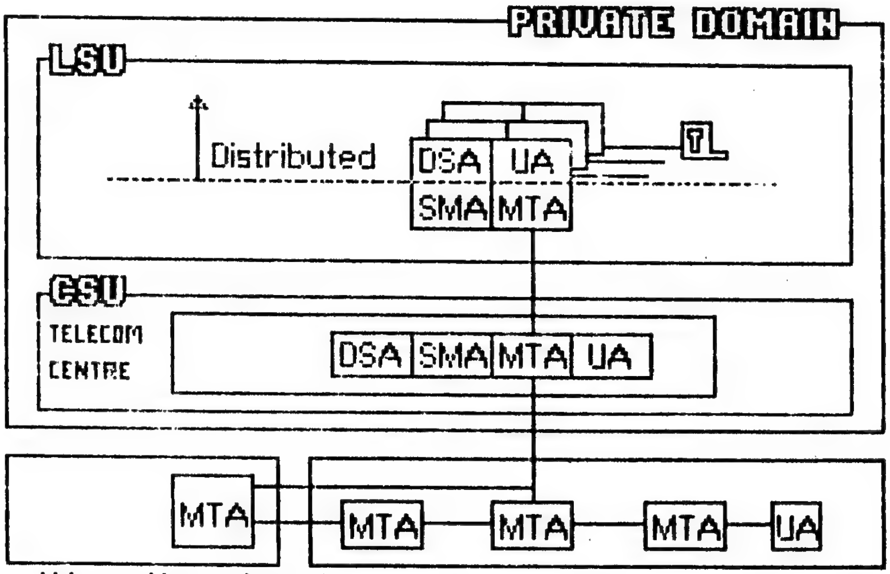
This initial implementation of electronic mail will allow urgent needs to be met while, at the same time, it will ensure that the technical, human and administrative infrastructure is ready to receive MHS products when they are available.

For economical reasons, and in view of the transient nature of the early implementation, it is not envisaged that each workstation should be furnished with the Teletex interfaces necessary to implement electronic mail. Instead, these will be concentrated on local servers.

The development of electronic mail services is being carried out in the framework of INSIS, and will be based on the relevant European Norms being defined by CEN-CENELEC and CEPT.

This development recognises the importance of the exchange of revisable documents within the context of electronic mail services. It, therefore, enriches the repertoire of standards on which these services are to be based by proposing compliance with an Office Document Architecture. This is the ODA/ODIF standard from ISO (DP 8613), the kernel of which is sufficiently stable.

The diagram below shows the distributed nature of electronic mail :



UA = User Agent
MTA = Message Transfer Agent
DSA = Directory Service Agent
SMA = System Management Agent

Diag.10

The user interacts with a **user agent (UA)** to create or receive messages. The UA liaises with a **Directory Service Agent (DSA)** to associate the names of other users of the electronic mail service with their addresses. This ends up in the creation of an "envelope" which is submitted, with the message, to the **Message Transfer Agent (MTA)**. Messages are relayed across MTAs until they reach the UA of the recipient. An MTA uses the services of a **System Management Agent (SMA)** which provides management tools and referral services.

There should only be a single MTA and a single SMA in each LSU. Directory Service Agents and User Agents, on the other hand, are ideally distributed to the workstations because they are directly related to the end user. Directory

Services will, however, be provided at higher levels also, through the electronic mail server of an LSU or the Telecommunications Centre for domain-wide or extra-domain information.

A central DSA is maintained in the TC, whose MTA will act as a gateway to the electronic mail services of other domains. Conversion between the text formats supported by the electronic mail service (ISO646, ISO6937 and ISO DP/8613 when finalised) is carried out at the MTA level. Conversion to one of these standards from, say, the internal format of a word-processor, is carried out by the UA.

The services covered are :

- Communication with other private domains via the X25 public services, using common conventions defined by the CEN/CENELEC functional standard A/3211 ;

- Communication with users of the MHS services provided by the PTTs, following the CEPT A/311 functional standard ;

- Communications within the domain.

In implementing the electronic mail service, the following principles are to be followed :

- Standard protocols will be used for the interchange of text over the DCN. These will be the P1/P2 protocols defined in the CCITT X.400 series of recommendations ;

- A standard access protocol (P7) will be used to access the electronic mail services. Pending the availability of this protocol, commercially available solutions will be used ;

- To deal efficiently with the traffic that will be generated, the aim should be to carry out communication with the MTA within an LSU over a LAN when this is feasible, and to dedicate a host to an MTA when this is justified.

5.5 Application Services

These services differ from the others in two ways :

- the level at which they operate. They tend to deal with a specialist area related to a topic of interest to one or more administrative section of the organisation ;

- their dependence on other services in carrying out some of their functions, as well as the lack of dependence of other applications on them : they are the top of a hierarchy.

Although application services are by far the most important category of services, as well in number, in size of data bases and the total development cost, there is very little to add for them from architectural point of view. They have to follow all the rules set out in this document and rely as much as possible on the other services.

6. OSI - STANDARDS PROFILES

6.1 Evolution

A complete and coherent set of standards profiles, specifying options and intercepts, is necessary at all times for the implementation of an architecture. The table below presents a synthesis of these profiles. Some important subjects are absent from this table. These are subjects for which neither an immediate standard solution is available nor is there enough information or experience for a decision on intercepts to be taken. These will be covered in the next edition of the Guidelines, and include the introduction of ISDN, LANs for the Domain Communication Network (DCN), and LANs other than Ethernet.

The table shows that it is possible, today, to implement a coherent architecture with almost no proprietory protocols. The only important exception is interactive communication.

The evolution towards an ideal world of open systems has a vertical and a horizontal component :

- Progress in the vertical sense takes place at the Transport Layer of the OSI model. Services which were previously built directly on the Network layer, now need to be lifted upwards to the Transport layer, becoming thus network independent (with the exception of X29)

- Horizontal progress takes place as intercept profiles are replaced by OSI profiles as soon as they become available. This migration is shown by the arrows in the upper layers of the table below.

The combination of both a horizontal and a vertical evolution at the transport layer is the reason why this layer is shown twice : the evolution of the networks is towards a fully standardised OSI Transport Layer (4), while some services will temporarily have to rely on the X-29 protocol or MPC which communicate directly with X-25 at the Network Layer (3).

	INTERACTIVE COMMUNICATION: LINE MODE	INTERACTIVE COMMUNICATION: SCREEN MODE	FILE & JOB TRANSFER	MESSAGE HANDLING
7 APPLICATION			--> JTM + FTAM + CASE	INTERIM -> SOLUTION ODA-KERNEL + MHS-MOTIS
6 PRESENTATION	X.29 + SIC S1	MPC + SIC S4 ---> VSM	MFTS --> ASN-1 CO-Pres	TELETEX -> MHS-MOTIS
5 SESSION			--> BSS	TELETEX -> BAS
4 TRANSPORT	ISO CLASS 4 + Adaptation		ISO CL 0 ---> ISO CL 0,2,4	TELETEX -> ISO CL 0,4

<u>Note</u> : The services specified by the columns of the upper table should be able to access the networks at the places where their layer 4 (Transport) appears in the lower table. The two tables are horizontally independent.

4 TRANSPORT	X.29	MPC	ISO CLASS 0,2	ISO CLASS 4
3 NETWORK	X.25 CONNECTION ORIENTED		OR	INTERNET CONNECTIONLESS
2 DATA-LINK	HDLC (LAPB)			LLC
1 PHYSICAL	X.21 BIS			ETHERNET (CSMA/CD)
	<------------PSDN------------>			<-----------------LAN----------------->
	<--DOMAIN COMMUNICATION--> NETWORK			<----------LOCAL COMMUNICATION----------> NETWORK

6.2 Network

The Domain Communication Network (DCN) should be connection oriented at layer 3 of the OSI-model to provide the necessary security, access management controls and appropriate resource allocation. Moreover, a unique addressing scheme, identifying LSUs should be available on the DCN to ensure the necessary routing control.

It is recognised that LAN implementation may imply connectionless (CL) local interhost communication at layer 3 (transport class 4) whereby the LSU is considered by the DCN as a distributed end-system. LCNs, therefore, must be physically isolated from the DCN, and communicate through a gateway addressable by the DCN. This is also necessary for security reasons and in order to separate the responsibilities for access and resource control taken by the Local Systems Administrator, as distinct from the DCN management. Isolated pieces of LAN, of the same LCN (e.g. for geographically separated equipment and users of the same community) will be linked by LAN-bridges and not through the DCN. Of course, this does not restrict the exceptional cases of LSUs corresponding to dispersed communities, such as international committees, or single workstation LSUs to communicate directly through the DCN, and/or the public networks.

The possible coexistence of direct end-to-end communication using different transport classes (class 0 and 2 at one end, with class 4 at the other) needs to be resolved at the LSU-gateway. For this reason, the structuring of layers at level 3 and/or 4 for all operational services has become of vital importance. This is a particular problem for three important basic services: interactive communication, file and job transfer, and message handling.

6.3 Interactive Communication

Interactive line mode communication is implemented using the X-29 protocol and the SIC-S1 specifications over the packet switched (X25) network. This type of communication will not evolve; instead it will be phased out and replaced by screen mode communication.

However, the X29 protocol has to be supported on LANs to give access, in line mode, to either local or common hosts. PAD emulators on local and personal computers may be implemented on either :

- connection oriented LAN over the ISO network protocol (ISO 8208) without any transport protocol, or

- connectionless LANs over the class 4 Transport protocol (ISO 8073) ; in this case, the X25/LAN gateway must provide the necessary adaptation to carry over the connection to hosts which use the X29 protocol over X25 without any Transport protocol.

Interactive screen mode communication between workstations and local or common servers, based on standard profiles, is very difficult to implement because :

- The long awaited Virtual Terminal Protocols (VTP) are still too far from being agreed to be considered for implementation ;

- The widely available CCITT X-29 protocol does not conform with the OSI model. In addition, it relies on X-25 at layer 3 and not on transport protocols ;

- The existing ISO standards (e.g. ISO 6429) cover too wide a range of functions on one hand, while on the other they do not include advanced features such as graphics, nor they do not define all necessary function elements required by the OSI model. Commercially available terminals and software products offer different, and often incompatible, subsets of these standards.

To support MPCs on LANs, a solution entirely parallel to the one suggested for X-29 above must be adopted.

The planned scenario for screen mode communication has to resolve two issues :

1. The interworking of the terminal and its access point, which may be located on a personal or local computer. It is proposed to adopt a standard which is a proper subset of already approved ISO-standards while, at the same time, close to the de-facto implementation of a sufficiently competitive range of commercially available terminals. Such a subset is defined in SIC-S4 and CEN/CENELEC will be asked to consider it urgently as an interim standard.

   The ISO-subset proposed by SIC-S4 is based on a compromise, whereby a limited functionality (VT200-like) is supported for remote communications (CSU-LSU and inter-domain), whereas higher functionality, such as graphics and image, is temporarily restricted to personal computers and communication with local computers. The SIC-S4 definition of the ISO-subset includes:

   - 4x96 characters with upper/lower case, accented latin and greek (optional), current and special symbols, mosaïc and colour (optional).
   - Cursor movements/tabulation/editing
   - Screen size 24x80

   SIC-S4 also defines lower levels of funcionality, corresponding with VT100-like terminals and line mode terminals, but which have to be supported by higher level terminals too.

2. The interworking of the terminal access point and the remote host.
   To address this problem, it is proposed to define a functional profile, called Virtual Screen Mode (VSM), which again should be based on existing standards and be close to de-facto implementations of terminals, as defined in SIC-S4. This solution is technically similar to the one presently implemented with Multi Protocol Converters, with one fundamental difference : the screens transferred over the network will conform to a standard and will not be proprietary. This should provide an incentive in the market for the suppliers of application softwares and terminals to line up to this interim standard, instead of continuing to support proprietary protocols. It is most important that CEN/CENELEC should start working in this direction urgently.

6.4 File and Job Transfer

Since the MFTS developments began in 1982, the Transport Station has been based on ECMA-72 class 0, which implied no Transport class negotiation. This Transport Station suited X-25 networks well.

To allow MFTS to exchange files between a host connected to the X.25 network and a host connected to a LAN, some adaptation may be necessary depending on the OSI layer at which a Connection Oriented Service is provided : network or transport layer.

- If the Connectionless Network Service (CL-NS) is used on the LAN, then the functional standard ENV.41.101 will apply. The MFTS end-system on the LAN will be based on the T/621X profile, while the MFTS end-system on X.25 will be based on T/311 profile. Then, the X.25/LAN Relay Function will be based on the R/31X1 profile.

MFTS			MFTS
ISO Transp. Class 4	ISO Transp. Class 4	ISO Transp. Class 0/2	ISO Transp. Class 0/2
INTERNET	INTERNET	X.25	X.25
LLC	LLC	HDLC	HDLC
ETHERNET	ETHERNET	V 24	V 24
LAN CL-NS T/621X	R/31X1		X.25 CO-NS T/311

To implement this solution, the Transport Station used by MFTS systems will need to be adapted : the LAN-MFTS systems will have to support a class 4 Transport Station, and the X.25-MFTS systems will have to be adapted to a class 0/2 Transport Station supporting class negotiation.

- If the Connection Oriented Network Service (CO-NS) on LANs is used, then the LAN-MFTS systems will be based on the T/611 profile while X.25-MFTS systems based on T/311 profile ; the X.25/LAN gateway will be based on the R/12 profile (cf. CEN/CENELEC profiles).

MFTS			MFTS
ISO Transp. Class 0/2			ISO Transp. Class 0/2
X.25	X.25	X.25	X.25
LLC	LLC	HDLC	HDLC
ETHERNET	ETHERNET	V 24	V 24
LAN CO-NS T/611	R/12		X.25 CO-NS T/311

In this solution, both LAN-MFTS systems and X-25 MFTS systems can remain unchanged (except for the network service interface on LAN) using the existing ECMA-72 class 0 Transport Station without class negotiation. To conform fully with the T/311 profile, however, the Transport Stations on both LAN and X.25 could be adapted to support transport class 0/2 and class negotiation.

MFTS will be replaced by ISO based products as soon as these are able to replace the MFTS functionality.

6.5 Message Handling

The message handling system will eventually conform to CCITT's X400 series of recommendations. Its implementation is divided into two phases, the first being ready for operation end 1986.

During the first phase, the application layer will consist of a minimum envelope sufficient for the immediate requirements, and similar in syntax to that defined in the CCITT X.430 recommendation. During the second phase, it will migrate to standard envelopes and headers as defined in the MHS/MOTIS model, in accordance with the functional profiles defined by CEN/CENELEC/CEPT. The document body will conform to the Office Document Architecture and Profile, as defined by ISO. A stable kernel of ODA is proposed as an urgent interim standard for CEN/CENELEC approval with the support of the INSIS community as well as the industry.

The presentation and session layers will evolve from Teletex based encodings and protocols during the first phase to those required by the X.400 series of recommendations during the second phase, notably the connection oriented presentation and BAS session and conforming to the relevant profiles defined by CEN/CENELEC/CEPT.

Finally, the transport layer, which will again be based on the Teletex T70 protocol during the first phase, will migrate to the ISO Transport of a class appropriate for the underlying network at any one time.

6.6 References to Standards Used in the Tables

6.1 Interractive Communication

* MPC "Multiple Protocol Converter" (based on a private protocols)
* SIC S1 : CEC SIC S1 "Teletype TTY Compatibility Requirements"
* SIC S4 : CEC SIC S4 "Screen Mode Terminal Compatibility Requirement"
* VSM "Virtual Screen Mode" (waiting for CEN/CENELEC functional standard)
* X3 "Packet Assembly/Disassembly Facility (PAD) in a Public Data Network"
* X28 "DTE/DCE Interface for a Start-Stop Mode Data Terminal Equipment Accessing the Packet Assembly/Disassembly Facility (PAD) in a Public Data Network situated in the same Country"
* X29 "Procedures for the Exchange of Control Information and User Data between a Packet Assembly/Disassembly (PAD) Facility and a Packet Mode DTE or another PAD

6.2 File and Job Transfer

* ASN-1 "Abstract Syntax Notation One" / ISO/DIS 8824.2 - ISO/DIS 8825
* CASE "Common Application Service Element" / ISO/DIS 8649.2-ISO/DIS 8650.2
* CO-Prs "Connection Oriented Presentation" / ISO/DP 8822(2)-ISO/DP 8822(2)
* ECMA-72 Class 0 "Transport Protocol" January 1981
* FTAM "File Transfer, Access and Management" / ISO/DP 8571
* JTM "Job Transfer and Manipulation" / ISO 8831 - ISO 8832
* MFTS "Multilateral File Transfer System"
  CEC File Transfer - Facilities based on NIFTP
* Session BSS "ISO Basic Synchronized Subset"

6.3 Message handling

* Interim Solution : Message Header derived from CCITT X430
* MHS-MOTIS "Message Handling System - Message Oriented Text Interchange System" (CCITT X400 Serie)
  CEN/CENELEC profile A/3211 - ISO/DIS 8505
* ODA-Kernel "Office Document Architecture" /ISO/DIS 8613
  - PDA-3 "Document Architecture Level"
* Session BAS "ISO Basic Activity Subset"
* TELETEX includes : T61 (Presentation), T62 (Session) and T70 (Transport)

6.4 Network and Communications

* ETHERNET (CSMA-CD) Carrier Sense : multiple access - collision detection
  ISO/DIS 8802.3 "Local Area Network"
* HDLC (LAPB) High Level Data-Link Control / ISO 7776
* ISO Transport class 0,2,4 : ISO/IS 8072 - ISO/IS 8073
  Class 0 : simple class
  Class 2 : multiplexing class
  Class 4 : error detection and recovery class
* LLC "Logical Link Control" / ISO/DIS 8802.2 "Local Area Network"
* X21 bis : Use on PDN of DTE which is designed for interfacing to synchronous CCITT V-serie modems, Version 1984

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END